REMARKS

Applicants' attorney would like to thank Examiner Lund for the interview granted on April 18, 2006. The interview was helpful in working out a strategy for future prosecution of the application. Applicants appreciate the Examiner's willingness to review the proposed revisions to the claims with respect to the § 112 rejection prior to the filing of a continuation application, which may be a Request for Continued Examination in the event the Examiner does not consider the proposed amended claims to be broader in scope than the claims prior to amendment.

Paragraph 40 of the Specification has been rewritten to correct an obvious typographical with respect to the numbering of the valve in one sentence.

Claim 1 has been amended in the manner recommended by the Examiner, to make it easier to read. An additional recitation of at least one process controller had to be added in view of the other amendments made to Claim 1. One skilled in the art will recognize that although several process controllers may be used to control a processing system, a single computerized control system can, and typically does, manage all of the process control devices for an entire apparatus. The overall recitation of at least one process controller is supported in Paragraph [0045] of the Specification, which describes the use of a computerized control system for controlling several process devices.

Claim 4 has been amended in the manner of Claim 1 to make it easier to read.

The Examiner suggested during the interview of the application that there would be an advantage in claiming a plurality of precursor vapor reservoirs. This claim is present in the form of dependent Claim 3. Applicants have added a new Claim 27 which depends from Claim 3 and includes capability for catalyst addition, in the manner of Claim 4 which depends from Claim 1.

Election/Restriction Requirement:

Upon seeing the restriction requirement in the February 14, 2006 Office Action, applicants' attorney contacted the Examiner, as the restriction requirement had been present in the first Office Action and applicants had responded by electing to prosecute Claims 1 - 10 and cancelling Claims 11 - 25. The Examiner acknowledged that the presence of the restriction requirement was an error and should be disregarded.

Objection to Claim 1:

The Examiner objects to Claim 1 on grounds that ", during" should be replaced by "chamber, during". However, in applicants' copy of Amendment "A" as filed on November 18, 2005, the second to last line reads . . . "into said process chamber", so the word chamber is already present prior to ", during formation . . ." which is being added in the last line of the claim. Unless the Examiner's copy of Amendment "A" is an earlier version than applicants thought they sent, to add "chamber, during" as requested by the Examiner would mean that the word chamber is present twice.

Claim Rejections Under 35 U.S.C. §112:

Claims 1 - 10 and 26 are rejected under 35 U.S.C. § 112, second paragraph for various reasons which are recited by the Examiner.

The Examiner suggests that the current claim language can be misinterpreted. Applicants contend that the present recitation is adequate in view of the description of the invention in the Specification, and particularly when considered in view of the drawings. The Examiner comments that the drawings only show one device (valve 132) to control the flow between the precursor container and the precursor reservoir. Applicants' drawings show two coating precursor containers, 128 and 140. Precursor container 128 sends vapor to expansion volume 134 (the precursor vapor reservoir which corresponds with the precursor container) and the device which controls the vapor flow from precursor container 128 to precursor vapor reservoir 134 is valve 132. The corresponding pressure sensor is 136. Precursor container 140 sends vapor to expansion volume 146 (the precursor vapor reservoir which corresponds with the precursor container) and the device which controls the vapor flow from precursor container 140 is valve 144. The corresponding pressure sensor is 148. Applicants contend that the claim is not confusing if one looks at the drawings, which illustrate precisely what applicants are claiming. One method of clarifying the meaning of Claim 1 would be to take numbers from the drawings and place them in the claims. However, applicants would prefer not to do this.

The Examiner has suggested that Claim 1 be amended to claim at least one coating precursor delivery system in general, with each precursor delivery system including a precursor container, a precursor reservoir with a pressure sensor etc. Applicants appreciate the Examiner's suggestion and agree that this approach will make Claim 1 easier to read. Applicants have amended Claim 1 to respond to this suggestion.

The Examiner has commented that Claim 1 recites the limitation "consisting essentially of" and that it is not clear what is excluded by this limitation. The terminology has been generally used by the Courts and the Patent Office to indicate that a claim is open for the inclusion of unspecified ingredients (or unspecified elements) that do not materially affect the basic and novel characteristics of the invention.

The Examiner then argues that applicants' Specification and Claims do not provide a clear indication of what the basic and novel characteristics are and what additions will materially change the characteristics of applicants' invention. In their Background Art section of the Specification, in Paragraph [0017], applicants recite: "The apparatus described for producing layers or coatings for use in electronic devices and/or micro-electromechanical systems devices enables application of the layers or coatings, but does not provide sufficient accuracy and repeatability in terms of the amount of the vaporous reactants provided to the substrate surface." . . . "Further, the ability to reproduce the same coating reliably, time after time, is diminished due to lack of control over the precise amount of reactants supplied to the coating formation process." . . . "It would be highly desirable to have a more accurate and reliable method of supplying precise quantities of the reactants to the process chamber and to the substrate surface for coating formation." Immediately after this, in the "Summary Of The Invention", in Paragraph [0019], applicants recite "We have developed an improved vapor-phase deposition method and apparatus for the application of layers and coatings on substrates." . . . "The coating formation method employs a batch-like addition and mixing . . . The precise addition of each of the reactants is based on a metering system where the amount of reactant added in an individual step is carefully controlled. . . . In particular, the reactant in vapor form is metered into a vapor reservoir with a predetermined set volume at a specified temperature to a specified pressure to provide a highly accurate amount of reactant. . . The entire measured amount(s) of each reactant is (are) **transferred in batch fashion into the process chamber** in which the coating is formed."

In Paragraph [0021], applicants recite: "A computer driven process control system may be used to provide for a series of additions of reactants to the process chamber in which the layer or coating is being formed". In Paragraph [0024], applicants describe a method of depositing the coatings, including "d) accumulating a nominal amount of the precursor vapor required for the vapor phase coating deposition; and e) adding the nominal amount of the precursor vapor to the processing chamber in which the coating is being deposited." In Paragraph [0034], applicants recite: "This apparatus is specifically designed to provide a high degree of control in terms of quantity of reactants

provided to the coating application process chamber **for each individual step, and in terms of the time and order at which these reactants are made available for the reaction.**"

It is clear that the applicants' apparatus is designed to carry out a process which employs at least one batch step and typically a number of batch steps in which a volume of reactant is charged in batch fashion to the reaction chamber. The accuracy available using the precursor vapor reservoir to measure out precise amounts of reactant, for each batch like delivery to the process chamber (whether a single step, or multiple intermittent steps), and the charging of a precise amount as a batch of reactant material is a feature of the invention. This is in contrast with continuous flowing deposition systems which make use of a carrier gas which contains reactants and the combination of gases is flowed over the substrate surface and out of the process chamber continually. One skilled in the art of reactions which take place on a surface will recognize the importance of the difference between a reactant which settles on the surface to react there and a reactant which is in constant motion moving past the surface.

The Examiner concludes in his office action that, since it is not clear that consisting essentially of limits the apparatus, he will consider "consisting essentially of" to be the same as "comprising". On this basis, the Examiner has rejected applicants claims.

Applicants contend that one of skill in the art, upon reading of applicants' Specification, will understand that the apparatus must be capable of the accurate measurement of a quantity of precursor vapor in a precursor vapor reservoir, with subsequent direct batch-like charging of the precursor vapor from the precursor vapor reservoir into the substrate processing chamber where the coating deposition takes place. Any residual precursor vapor and/or reaction by-products are exhausted after completion of the reaction. Applicants' apparatus is not capable of mixing of a carrier gas with precursor vapors from the precursor vapor reservoir and subsequent transfer of a uniform mixture of a gas/vapor to the processing chamber. Applicants' apparatus does not include elements which provide for control of a pressure in the processing chamber by balancing inlet and outlet gas flows during the coating deposition. These additional elements of apparatus are necessary when carrier gas is used in the manner described by Hatano, and as illustrated in Hatano Figure 1. Not only does the Hatano

apparatus operate in a different manner, but the difference in operation affects the product which is produced by the apparatus, as discussed during the telephone interview on April 18.

Applicants' inventive method of coating requires an apparatus which provides for delivery of a precise quantity of reactant to a substrate surface, where it is permitted to settle and react. After reaction, the process chamber is evacuated. This step may be repeated a number of times with the same reactant precursors or with a combination of different reactant precursors. The continuous flow reactors, operated at a constant flow rate, provide a given residence time for a mixture of carrier gas with precursor (where the mixture composition may not be accurate or constant), where some quantity of precursor may react with the substrate surface, depending on the amount of motion at the substrate surface. The invention as claimed in Claim 1 which recites "consists essentially of" excludes apparatus which include devices to provide for constant mixing of carrier gases with precursors, and which include devices which provide a constant flow of such mixtures over the substrate surface during formation of a coating. The devices which are excluded teach away from and would materially change the apparatus and method of coating which are described and claimed by applicants.

Claim Rejections Under 35 U.S.C. §102:

Claims 1, 2, 9/1, 9/2, and 10 are rejected under 35 U.S.C. § 102(b) as being anticipated by Hatano, U.S. Patent 5,989,345. As previously discussed, the Hatano reference is a process gas supply apparatus for supplying process gas to a substrate processing chamber. The process gas, $TiCl_4$ in particular, is mixed with a carrier gas prior to entry into the substrate processing chamber. The carrier gas is said to "guide" the process gas into the substrate processing chamber. However, since the carrier gas is continually added during deposition of a coating, and since NH_3 is also shown as being continually added to the process chamber during coating deposition, independently of the carrier gas $TiCl_4$ mixture, it becomes even more evident that the additional apparatus required for the Hatano coating deposition method teaches away from applicants' apparatus which excludes the additional apparatus present in Hatano. (Please

see Col. 3, lines 19 - 24; Col. 4, lines 19 - 26; and Col. 7, lines 9 - 18.) When the Hatano patent Specification is read as a whole, it is readily apparent that the process being carried out is substantially different from applicants' process and the apparatus used to carry out the process is substantially different – to the point of teaching away from applicants' invention. One of skill in the art, upon reading the Hatano reference would not arrive at applicants' invention.

Applicants' invention is focused on an apparatus and method which enable the use of coating/thin film-forming precursor materials which have a very low vapor pressure. These materials are a liquid or a solid at room temperature and are difficult to handle without condensation on surfaces they contact. They cannot readily be forced through complicated valving systems used for mixing without a condensation problem. Applicants' Claim 1 includes the recitation that at least one coating precursor used for formation of the coating exhibits a vapor pressure below about 150 Torr at a temperature of 25 °C. While this is a functional limitation and is not a part of the apparatus, it is directly tied to the ability of the apparatus to perform as required. The elements recited in applicants' apparatus of Claim 1 are capable of being used in combination with such a coating precursor without problems which are encountered by complicated multiple valving and carrier gas flow systems of the kind described in the Hatano reference.

Applicants' apparatus is used to deposit thin layers/coatings where at least one coating precursor, and in some instances a catalyst in addition to a coating precursor, is transferred to the substrate processing chamber in a manner such that the vaporous coating precursor and the vaporous catalyst, if present, each remain unaltered during the transfer to the substrate processing chamber. There is no carrier gas mixed with the coating precursor or a catalyst. As a result of not using a carrier gas, the system for delivery of the coating precursor, and catalyst if used, is much simpler. Further, there is no carrier gas to contaminate, dilute, or interfere with the coating formation reaction taking place at the substrate surface.

The Hatano process gas delivery system makes use of a carrier gas in all embodiments. As a result, there are necessary piping and complex valving systems which connect a "gas storing section" to a carrier gas introducing pipe, and additional valving with at least one open/shut valve. In addition, the controlling section for the process gas supply apparatus of Hatano also includes a communication state between the carrier gas introducing pipe and the gas storing section and requires a "switchover" of the open/shut valves attached to the process gas filling circuit and the process gas releasing circuit.

In view of the distinctions between the apparatus described and claimed by applicants and the apparatus described in the Hatano reference (which teaches away from the present invention), the Examiner is respectfully requested to withdraw the rejection of Claims 1, 2, 9/1, 9/2, and 10 are rejected under 35 U.S.C. § 102(b) as being anticipated by Hatano.

Claim Rejections Under 35 U.S.C. §103:

Claims 2 - 8, 9/4, 9/5 and 26 are rejected under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent 5,989,345 to Hatano. The Examiner admits that Hatano differs from the claimed invention in that Hatano does not teach a plurality of process gas supply systems for other precursors and catalysts, but then argues that there is motivation for duplicating the gas supply system of Hatano to enable the supply of multiple precursors and other gases such as catalysts in order to deposit multiple types of coatings. This argument does not illustrate that applicants' invention is obvious. Since the Hatano reference teaches the use of a carrier gas in combination with reactant material, to form a mixture which constantly flows past the substrate surface, the Hatano reference teaches away from applicants' invention for the reasons described above. Duplication of apparatus which teaches away from applicants' invention does not render applicants' invention obvious.

Further, with respect to Claim 4, the Hatano reference does not discuss the use of a catalyst to obtain the reaction of process gases which are used to form the coating or thin layer

on the substrate surface, and therefore does not describe the apparatus to be used for this function.

The Examiner is respectfully requested to withdraw the rejection of Claims 2 - 8, 9/4, 9/5 and 26 under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent 5,989,345 to Hatano

Claims 1 - 10, and 26 are rejected under 35 U.S.C. § 103(a) as being unpatentable over Sneth et al., U.S. Patent 6,503,330 B1, in view of Hatano, U.S. Patent 5,989,345.

The subject matter described in the Hatano reference is distinct from the present invention for the reasons discussed above. As previously discussed in the last amendment, the Sneth et al. apparatus shown in Figure 11 provides for a constant flow of gas across the wafer surface. Sneth et al. describes the use of a carrier gas which is fed into an inlet in a mixing manifold 38, which is used to mix the various processing gases. The mixed carrier gas and processing gases are directed to a plasma forming zone 39 for forming a plasma. The plasma which is formed is then fed into the gas distributor 35 and then into the chamber 31. This teaches away from applicants' apparatus which enables charging of individual coating precursors to the process chamber in unaltered form, without mixing with a carrier gas, without premixing of coating precursors prior to charging to the substrate coating chamber, and without converting the precursors into a plasma prior to charging the precursors to the substrate coating chamber.

One skilled in the art will recognize that this difference in processing of materials prior to charging of materials to the processing chamber affects the coating produced to an extent that it totally changes the performance of the coating produced. The introduction and background art in the Sneth et al. reference describes the kinds of affects on the coating which occur using different charging schemes for reactant materials, for example.

The apparatus described by Sneth et al. is completely different from the apparatus described and claimed by applicants, because the method of coating deposition is completely different. There is no suggestion of applicants' apparatus in the Sneth et al. disclosure.

Both the Hatano reference and the Sneth et al. reference make use of layer deposition methods which require the use of a carrier gas. As a result, both of these references require a large number of coordinated and controlled apparatus elements which are not present in applicants' apparatus. Applicants' claims have been amended to recite "consists essentially of"to make it clear that complex switching valve systems, mixing manifolds, and in-line plasma creation from process gas sources of the kind illustrated in the Hatano and Sneth et al. references, respectively, are not present in applicant's apparatus. Applicants' precursor materials are likely to condense out in such systems, affecting the accuracy of the amounts of precursor materials charged to the process chamber. A review of the apparatus shown in applicants' Figure 1 and the accompanying description makes it clear that applicants' intent is a minimalist approach which delivers carefully measured and controlled amounts of at least one coating precursor to a process chamber without altering the composition of the coating precursor prior to its entry into the processing chamber.

Applicants' exhaust port 112 from the process chamber 102 is used for the removal of reaction byproducts after a coating deposition in the process chamber, as described in Paragraph [0037], Page 13, lines 20 and 21 of applicant's Specification. Applicants' exhaust port is not designed to permit a constant flow of carrier gas (or reactive gas) through the processing chamber, and the additional apparatus to make this possible is not described or claimed. One skilled in the art reading the teachings in the Hatano and Sneth et al. references would not

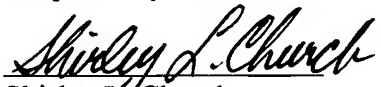
contemplate the apparatus disclosed and claimed by applicant, which would not be capable of carrying out the coating deposition processes described in these references.

I view of the above distinctions, the Examiner has not made a prima facie case of obviousness. The Examiner is respectfully requested to withdraw the rejection of Claims 1 - 10 under 35 U.S.C. § 103(a) as being unpatentable over Sneth et al., in view of Hatano.

Applicants contend that amended Claims 1 - 10 and Claim 26 are currently allowable, and the Examiner is respectfully requested to enter the amendments requested herein and to pass the application to allowance.

In the event that the Examiner would like to ask any questions or make suggestions with respect to the application, the Examiner is invited to contact applicants' attorney at the telephone number provided below.

Respectfully Submitted,



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